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ABSTRACT

Educators must use computers to move society beyond the information age and toward the age of wisdom. The movement toward knowledge and wisdom constitutes an evolution beyond the "third wave" or electronic/information age, the phase of history in which, according to Alvin Toffler, we are now living. We are already moving into a fourth wave, the microbiotechnological age, which has at its base the powerful combination of the computer and the explosion of knowledge. This fourth wave is driven by knowledge as applied to natural and social phenomena and is aligned with the more traditional notion of subject matter. In the fourth wave computers will be turned more toward specific disciplines and will give up a great deal of their former task as organizers of information; students will need to spend time with computers within subject areas. In order to reach the fifth wave, known as the age of wisdom and judgment, attention must be paid to the concept of opportunity. There must be equal opportunity for computer usage relative to class, race, and sex; there must be fair use of computers across discipline lines; and the computer must be used to help educators teach more knowledge in school programs. (RM)

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Computers and Social Knowledge: Opportunities and Opportunity Cost

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The computer presents educators with two powerful conceptions. One is expressed in Pogo's observation that "...we always seem to be confronted with insurmountable opportunity." The other is presented best in T. S. Eliot's poem, "The Rock."

> Where is the knowledge we have lost in information?
> Where is the wisdom we have lost in knowledge?

Opportunity becomes insurmountable to the degree that we are unprepared or unwilling to make enlightened choices among alternatives. However, when those alternatives appear as confused conceptions of knowledge or as disoriented epistemologies, then pedagogically we proceed at great risk. An important context in which to consider this risk is provided by Eliot's delineation of information, knowledge and wisdom.

Notions of information, knowledge, and wisdom differ significantly. Information is one-dimensional. It is linear or horizontal, fragmented, and quite useless in and of itself. Knowledge is structured information that shows relationships between and among bits of information. Knowledge is best represented by theories about natural and social phenomena, it is created basically within content areas, and it tends to be field specific. Wisdom is the organic application of information and knowledge to human dilemmas, desires, and dreams. Wisdom is that quality of thought and imagination that ties us to our cultural heritage and gives us the ability to find and build the moral framework upon which human life is defined and within which meaning resides. The patterns of life, constructed upon this framework, are manifested in the motive concepts of our culture-concepts such as justice, love, courage, and beauty.

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That information, knowledge, and wisdom are different ways of knowing is a fact that has direct implications for educators. First of all, it is critical to have students involved with all three levels of thinking and knowing, so that information can be tempered with wisdom as well as with knowledge. This is particularly important today, since we have reached a point in history when the computer can actually perform the human function of organizing and passing on information. Second, we should understand that wisdom is more important than knowledge and knowledge more important than information. While all three are needed to keep any society healthy, the areas of knowing most needed and most useful are knowledge and wisdom. Information, particularly in an information age such as ours, is by definition everywhere abundant. Knowledge and wisdom, on the other hand, are not only scarce, but seem to be fading from importance. Yet, the latter two ways of knowing are necessary if information is to be used in helping to make the human condition better. This is the central issue, the central function in our relationship with technology. However, in our educational programs we tend to place most emphasis and to spend most of our resource on information. Why is this the case? Perhaps, because teaching information is easier than teaching knowledge and wisdom. Information is easier to test and to write textbooks for, and it is getting more than its fair share of new computer software. On the other side of the argument, we know that the teaching of knowledge and wisdom calls for school programs that are coordinated, for teachers and administrators who behave as members of a community of scholars, and for an understanding of the computer (technology) that can enhance knowledge acquisition and social judgment.

When decisions are made about computer utilization and the curriculum, a conscious choice should be made regarding time allocations for information, knowledge and wisdom. That is , the time devoted to information varies inversely with time spent on knowledge or wisdom. We must understand this trade-off first, regardless of the content area under consideration.

If we consider Pogo's conception of opportunity then we must know that the cost of the computer is not only its purchase price and operational expenses, but also the "cost" of the time, books, and opportunities it replaces. At one level, this trade-off can simply mean a new and better way of having students confront information and, to some extent, knowledge. But we need to make different kinds of choices relative to computer use, for, like it or not, computers will continue to affect the way we live,

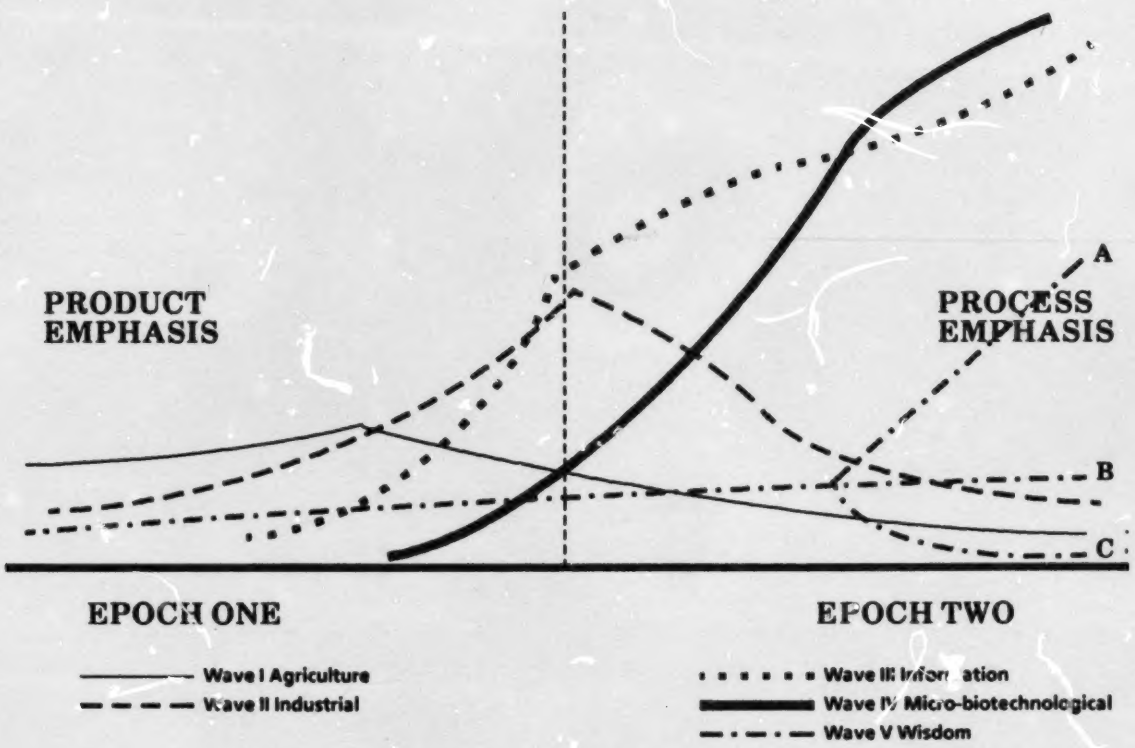
the way we learn, and the way we teach. For example, our telecommunications networks are already converted into computer based systems of incredible sophistication. This development should have some positive impact on education as it facilitates access to the larger world community. Computer usage will also lead to the development of hybrid subject matter, such as social mathematics (the statistical study of social phencmena), and techno-ethics (the study of the ethical implications of technology). Thus, the opportunity cost of the computer includes our willingness to put aside some traditional subject matter, some established classroom methods, and some of our romantic attachments to information. Our conception and handling of information will determine whether we continue to use computers as electronic workbooks or as vehicles that can help us explore the domains of knowledge and wisdom. The movement toward knowledge and wisdom is, in a sense, "insurmountable," because it constitutes an evolution beyond the "third wave," the phase of history in which we are now living, so vividly described by Alvin Toffler in his book by the same name.

In his delineation of historical stages Toffler labels the first wave as the agricultural age, the second as the industrial age, and the third wave as the information/electronic age. A significant difference exists between the first two waves and the third wave; a difference having to do with conceptions of product and process. The first and second ages were product revolutions while the information age is a process revolution. The notions of product and process differ in their conceptualization of economic capital. Information and knowledge have become the capital of today. Knowledge has always been related to power; now it has also become the very center of our economy, the critical resource. Knowledge is not, of course, a physical and finite resource, but an abstract and infinite one. We must, however, develop a way to use or interject knowledge into our economic, political and social systems in much the same ways that fossil fuel was interjected into the economies of the late 19th century and the first three-quarters of the 20th century. Just as our economy became energy-intensive with the industrial age, today it is becoming knowledge- and information-intensive. Thus, the emergence of information as a major form of energy is finally becoming recognized. It is the first energy form which, methaphorically, stands outside the second law of thermodynamics. That is, it is not "running-down," nor is it generating heat and friction; it can also be stored with minimal losses almost indefinitely. Economically speaking, we are seeing a shift from products built with high temperatures, high

pressures, and high power to processes built with "low entropy" with little disorder to the earth's energy systems. An illustration of this shift is the reduction in the size of computers because of the replacement of vacuum tubes by the microchip. What once took a three-story building to contain can now fit into the space the size of one's fingernail.

This emphasis upon low entropy, on information, and on process, then, represents a break in the history of cultural evolution. The first two waves described by Toffler can actually be seen as parts of the same evolutionary theme; that of product and high entropy. But the third wave presents a new evolutionary theme – – that of information, process, and low entropy. Building upon the base formed by agriculture and industry, we are beginning a new period in the life of the human species.

We are beginning a second evolutionary epoch. Epoch two, which includes Toffler's third wave, will also bring technological and institutional revolutions and will produce a rapid, erratic, and geometric growth of information. In a sense, we are moving into the third wave at such a high rate of speed that the fundamental nature of reality is changing. This new reality is based upon different conceptions of time, information, and systems that will carry us beyond the third wave and into a fourth and even a fifth wave. The following chart presents an image of five waves and their relative importance (one to another) through time. Note especially the way in which the five waves move across epoch one and epoch two. All five waves are represented in both epochs, but wave five is still beyond our abilities of prediction.



Thus, while the information wave is still quite young, beginning after World War II, we are already moving into a fourth wave which we might call the micro-biotechnological age. A micro-biotechnological age has at its base the powerful combination of the computer and the explosion of knowledge. This will allow the focused power of information to blast through new research and development frontiers. This revolution seems to have in store for us a whole array of "super-stuff." From microbes that can clean up oil spills in the ocean to artificial life and artificial intelligence, we are seeing the science lab alter our realities; with these altered realities, ethical dilemmas are springing up like weeds in the human vineyard. This "fourth wave" is driven by knowledge as applied to natural and social phenomena and is aligned with the more traditional notions of subject matter or discipline study.

It is within this fourth wave that computers will have to be turned more toward specific subject matter such as biology, economics, and literature and will have to give up a great deal of their former task as "organizers of information." To be sure, there are estimates that within the next ten years information will increase 100% every 24 months. But, this information load will still be manageable as computer

capacities increase. The educator's task today is to help students pay less attention to information per se and more attention to the training of their minds, so they can function within subject fields and across disciplines. In other words, students will need to spend time with computers within subject areas so that they can learn the logic or syntax of those epistemologies. This practice is at the base of developing intellectual skills.

Because of the progress and problems generated by information and knowledge, we must find the logical and ethical means both to create and to move beyond the fourth wave and toward artery 'A' of the fifth wave (see chart above). This fifth wave will represent the mature stage of epoch two, and, if we take route A as opposed to B or C, this wave will be known as the age of wisdom and judgment. If we fail to reach this domain, then we will fail to survive as a species.

Again, we will have a better chance to approach the mature stage of epoch two if we pay careful attention to the concept of "opportunity." First, we need to make more equal the opportunity for computer usage relative to class, race and sex. This seems not to be the case today. In studies done at the University of Minnesota, Ronald E. Anderson found that computer utilization is skewed toward those school districts and children who come from the higher socio-economic levels. Further, girls and women are under-represented in their utilization of computers as are children from minority groups.

Second, we need to be more fair in our use of computers across discipline lines. Academic areas other than mathematics need an opportunity to participate. Specifically, social studies, language arts, and science must become "more equal" (to mathematics) in time utilization. Further, the computer must be at home within the humanities so that it can help in our journey toward route A of the fifth wave.

Finally, we must move pedagogically and philosophically toward wisdom by allowing the computer to help educators teach more knowledge (i.e., subject or discipline study) in our school programs. This trade-off will afford the time for judgment, truth, and celebration. With this time we can better search for rational unity. That is, we can try to explain life and its meaning. It is this search that can lead us to the fifth wave (the age of wisdom). And, if we can engage the computer

properly in this work, we may be able not only to search, but actually to come to know the essense of our human nature and spirit; we may approach truth.

Abraham Heschel makes the point this way:

> Truth is more than the equation of thing and thought. Truth transcends and unites both thing and thought. Truth is transcendence, its comprehension is loyalty.
>
> To the sense of indebtedness, the meaning of existence lies in reciprocity. In receving a pleasure, we must return a prayer; in attaining a success, we radiate compassion. The world is not mere material for exploitation. We have the right to consume because we have the power to celebrate.
>
> Since indebtedness is an essential ingredient of existence, the inability to celebrate is a sign of insolvency, of an inability to pay the existential debt.
>
> There is no celebration without earnestness, without solemnity and reverence.
>
> We are losing the power of appreciation; we are losing the ability to sing. Celebration without appreciation is an artificial, impersonal ceremony. A renewal of our strength will depend on our ability to reopen forgotten resources.
>
> The meaning of existence is experienced in moments of exaltation. Man must strive for the summit in order to survive on the ground. His norms must be higher than his behavior, his ends must surpass his needs. The security of existence lies in the exaltation of existence.
>
> This is one of the rewards of being human: quiet exaltation, capability for celebration. Man in quest for an anchor in ultimate meaning is far from being a person shipwrecked who dreams of a palace while napping on the edge of an abyss. He is a person in full mastery of his ship who has lost his direction because he failed to remember his destination. Man in his anxiety is a messenger who forgot the message. (pages 117-119)

The opportunity is here for us to grasp. The question at issue is whether or not we can remember our message. The message, to educators, is the expression of our responsibility to help students search for wisdom. And, while the computer can help in this expression, only the human mind has at its calling the ability either to enhance or to reduce the power of ignorance and evil. In the end, the education of most social worth is basically that which provides the wisdom that can best destroy those areas of ignorance most dangerous to human life and spirit. The computer can be a significant ally in this endeavor if, and only if, we use it to move society and ourselves beyond the information age and toward the age of wisdom.

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Software

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